International Journal of Geriatric Psychiatry

Title: Pain assessment and pain treatment for community-dwelling people with dementia: A systematic review and narrative synthesis

Short running title: Pain in community-dwelling people with dementia

Authors:

Laurna Bullock[a]*

John Bedson[a]

Joanne L. Jordan[a]

Bernadette Bartlam[b,a]

Carolyn A. Chew-Graham[a, c]

Paul Campbell[a, c]

[a] Research Institute for Primary Care and Health Sciences, Keele University, Staffordshire, UK, ST5 5BG

[b] Family Medicine and Primary Care, Lee Kong Chian School of Medicine, Nanyang Technical University Singapore, Singapore 308232

[c] Midlands Partnership NHS Foundation Trust, St George's Hospital, Stafford, ST16 3AG, UK

*Corresponding author:

Laurna Bullock

Research Institute for Primary Care and Health Sciences, Keele University, Staffordshire, UK, ST5 5BG

01782 734985

l.bullock@keele.ac.uk

Word count – Abstract: 247

Word count – Main text: 4526

Sponsor:

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors**.** This work however forms part of a PhD project which received funding from Keele University ACORN studentship.

Abstract

Objectives

To describe the current literature on pain assessment and pain treatment for community-dwelling people with dementia.

Method

A comprehensive systematic search of the literature with narrative synthesis was conducted. Eight major bibliographic databases were searched in October 2018. Titles, abstracts, and full-text articles were sequentially screened. Standardised data extraction and quality appraisal exercises were conducted.

Results

32 studies were included in the review, 11 reporting findings on pain assessment tools or methods, and 27 reporting findings on treatments for pain.

In regard to pain assessment, a large proportion of people with moderate to severe dementia were unable to complete a self-report pain instrument. Pain was more commonly reported by informal caregivers than the person with dementia themselves. Limited evidence was available for pain focused behavioural observation assessment.

In regard to pain treatment, paracetamol use was more common in community-dwelling people with dementia compared to people without dementia. However, non-steroidal anti-inflammatory drugs (NSAIDs) were used less. For stronger analgesics, community-dwelling people with dementia were more likely to receive strong opioids (e.g. fentanyl) than people without dementia.

Conclusion

This review identifies a dearth of high quality studies exploring pain assessment and/or treatment for community-dwelling people with dementia, not least into non-pharmacological interventions. The consequences of this lack of evidence, given the current and projected prevalence of the disease, are very serious and require urgent redress. In the meantime, clinicians should adopt a patient and caregiver centred, multi-dimensional, longitudinal approach to pain assessment and pain treatment for this population.

Systematic review registration: PROSPERO CRD4201705790

Keywords:

Dementia; Community; Pain, Pain Assessment; Pain Treatment; Pain Measurement; Pain Management; Analgesics

Key points:

- Timely recognition of pain for people with dementia is important to ensure effective management and reduce adverse effects of medication.
- Clinicians should adopt a multidimensional approach to pain assessment including self-report assessments, pain history information, physical examination, informant-based ratings, and observation of pain behaviours.
- For patients with dementia, regular and structured medication reviews to assess the use, efficacy, and side effects of analgesic prescriptions are essential.
- Further high quality, longitudinal research is essential to examine the management of pain and the most effective pain management strategies for community-dwelling people with dementia throughout the progression of disease.

1 Introduction

The world's population is ageing, with the global population of people aged 65 years and older projected to grow from 901 million in 2015, to almost 2.1 billion by 2050.[1,2] Aligned to this population rise, is the increasing prevalence of dementia. In 2015, approximately 47 million people were living with dementia worldwide; this rate is projected to increase to 131 million by 2050.[3,4] One common comorbidity associated with aging is painful conditions (e.g. musculoskeletal pain),[5] and it is estimated that approximately 50% of people with dementia have a painful condition, concordant to older adults without dementia.[6]

Symptoms associated with dementia (e.g. diminished language capacity, memory impairment, and behavioural symptoms) may lead to difficulties articulating a pain experience.[7] Consequently, caregivers and clinicians may not recognise or interpret expressions of pain correctly, and thus may inadequately assess and treat pain.[8] Poor pain management for people with dementia can cause adverse outcomes, such as neuropsychiatric symptoms, decreased quality of life, increased caregiver burden, and avoidable institutionalisation. It can also result in adverse drug events such as confusion, falls, and opioid overdose.[9-12] Research conducted in residential, palliative, and acute care settings show that people with dementia are often treated differently compared to those without dementia.[13-20] Furthermore, recent randomised control trials within these settings provide evidence that a step-wise prescription of analgesics can lead to a reduction in a range of neuropsychiatric symptoms and mood syndromes.[21,22]

Whilst this evidence shows the benefits of assessment and treatment of pain in people with dementia, the focus of such research has been largely restricted to formal care settings (e.g. nursing homes), as reflected in a number of existing systematic reviews[23-29] and a recent meta-review.[30] As a consequence, the evidence is almost exclusively based on people with high severity dementia (i.e. those without verbal communication capacity)[26-28] and very little research into pain assessment and/or treatment has been conducted amongst community-dwelling populations.[29] This highlights a significant knowledge gap in understanding the needs of community-dwelling people with dementia; this population will have greater diversity in the capacity to self-report their pain, and differences may exist in proxy reports from informal caregivers compared to caregivers within formal settings who may have professional training in assessment. Given that upward of 60% of people with dementia reside within community settings in the UK,[31] this is a pressing concern.

This review aims to describe the current literature on pain assessment and pain treatment for community-dwelling people with dementia. Specific objectives are to: i) synthesise the evidence on the use of pain assessment tools and methods, and assess their utility within community-dwelling people with dementia; and ii) synthesise the evidence on the use of pain treatments and evidence of efficacy for community-dwelling people with dementia.

2 Methods

2.1 Patient involvement

A patient and public involvement meeting was organised with caregivers of people with dementia during project development. Caregivers shared their personal experiences of the complexity of pain assessment and management for their relative with dementia, reiterating the importance of systematically reviewing the evidence on pain assessment and pain treatment for community-dwelling people with dementia.

2.2 Search strategy

A comprehensive search strategy was applied within the following electronic databases: MEDLINE, EMBASE, AMED (Allied & Complementary Medicine Database), AgeLine, CINAHL, PsycINFO, Web of Science Core Collection, and The Cochrane Library from inception to October 2018 (see supplementary Table S1 for the MEDLINE search strategy). Searches were designed and conducted

by LB with agreement and oversight from PC, JB, and JJ (research information specialist). No search limits were applied for study design, date, or language of publication. Further supplementary searches were conducted in Google Scholar, and all reference lists of all included papers were hand screened. A citation search of all included papers were tracked to ascertain subsequent potential publications, as well as a screen of all reference lists of relevant commentaries, literature reviews, and systematic reviews.

2.3 Criteria for considering studies for this review

Inclusion

- Study participants must have a confirmed diagnosis of dementia and reside in the community (including living alone at home, with informal caregivers at home, retirement communities, warden-controlled housing, or assisted living).[31]
- Studies examining the use of self-report, informant-report, and behavioural observation tools and methods of pain assessment.[32]
- Studies examining the use of treatments for pain (including pharmacological, and non-pharmacological treatments for pain).
- Studies evaluating the effectiveness of treatments for pain (both pharmacological and non-pharmacological) with a pain assessment tool.
- Full text peer-reviewed scientific journal articles.
- Studies published in English or other languages translatable via colleagues at the Research Institute.

Exclusion

- Studies with participants with dementia in nursing home, palliative, or hospital settings. If a study includes participants with dementia living in a variety of residential settings (e.g. nursing home and community), the study will be excluded if the results specific to people with dementia living in the community cannot be extracted independently.
- Studies solely focused on malignant pain. Cancer pain and its management is distinctly different from other common pain conditions.

Inclusion of papers involved a number of stages:

- Title screen to remove obviously irrelevant references (LB).
- Abstract screening and full text screening (LB), with 20% of the abstracts and full texts screened independently by PC with good interrater agreement (>95%). Discrepancies were resolved in discussion with a third reviewer (JB).

2.4 Data extraction

Data extraction was completed by LB and checked for consistency and accuracy by two other authors (PC and JB). Data were extracted onto a standardised data extraction form. The extracted data included: participant characteristics and information on the type of pain assessment and pain treatments. LB contacted the authors of potentially eligible papers if additional information or clarification was required.

2.5 Quality appraisal

Study quality was assessed using the National Institute of Health (NIH) Quality Assessment toolkit[33] for a number of study designs (case-control, observational cohort, cross-sectional, controlled intervention, and pre-post studies with no control group). Each tool consists of 11 to 14 items (dependent on design type), each evaluated as “yes”, “no”, or “not applicable/cannot decide” as guided by NIH guidance. Each item focused on the concepts, questions, and domains that are integral for the critical appraisal and evaluation of internal validity, including potential biases,

confounding, and study power. Each item was used to guide the overall quality rating of "good," "fair," or "poor". A 20% sample of the studies were blind checked by PC to ensure consistency. Discrepancies were resolved in discussion with a third reviewer (JB).

2.6 Analysis

Due to heterogeneity of the sample populations, settings, study designs, interventions, and reported outcomes, as well as a lack of statistical information to perform a meta-analysis, a narrative approach was adopted. The initial analysis stage assessed and described the quality of the included studies. Each study was assigned to the overarching theme or "cluster"[34] of "pain assessment" and/or "pain treatment". Studies were further clustered thematically to form sub-domains. Sub-domains for pain assessment were self-report, informant-report, and behavioural observation. Sub-domains for pain treatment were pharmacological (further clustered by analgesic potency) and non-pharmacological treatments. Studies were tabulated based on their domain and sub-domain to allow for preliminary comparison within and across studies. The systematic approach to the narrative synthesis allowed the identification of patterns across the data in order to draw informative conclusions relevant to current research, policy, and practice.[34]

3. Results

Searches identified 6741 unique records (up to October 2018), of which 129 were screened at full-text stage. One potentially eligible paper could not be obtained in full text.[35] Three additional papers were found through the supplementary searching, resulting in 32 studies included within the review (See Figure 1). Of the included studies, 11 reported findings on pain assessment tools or methods (see Table 1), whereas 27 reported findings that explored treatments for pain (see Table 2 for an overview of pain treatment use and Table 3 for pain treatment effectiveness). 16 studies were conducted in North America, 8 in Finland, 2 in Denmark and 1 each in Canada, Northern Ireland, Sweden, France, Japan and Italy.

[Insert Figure 1]

3.1 Quality assessment

Using the NIH Quality Assessment tools, 4 studies (12%) were assessed as good quality, 21 (66%) as fair quality, and 7 (22%) as poor quality.

Observational study designs were assessed using the NIH Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies. Many questions in the tool received a high percentage of "no" responses largely because of the cross-sectional designs. For example, only seven (22%) studies investigated the exposure prior to the outcome (question 6), four (13%) provided sufficient timeframe for the outcome to occur (question 7), and three (9%) measured the exposure more than once during the study period (question 10). A "no" response did not necessarily lead to a poor quality rating, but rather indicated areas of potential biases that may influence the relationship between the exposure and outcome associated with cross-sectional designs. Intervention studies were quality assessed using the NIH Quality Assessment Tools for Controlled Intervention Studies, or Pre-post Studies with No Control Group depending upon the presence of a comparator group (see supplementary Table S2 for detailed quality assessment).

3.2 Pain assessment tools and methods

Eleven studies investigated pain assessment tools and methods for community-dwelling people with dementia. Five studies examined self-report pain tools, six studies examined informant-based ratings of pain, and one study examined a behavioural observation tool.

Only one study provided an overview of the frequency of pain assessment in primary care,[37] with pain assessment documented in 98% of patients' medical records. Of the pain assessments documented in this study, 98% used the Numerical Rating Scale (NRS), Visual Descriptor Scale (VDS), or Faces

Pain Scale (FPS), whereas only 2% of medical records reported modifications of pain scales for cognitive impairment.

3.2.1 Self-report

Four studies (1 good quality,[36] 1 fair quality,[37] and 2 poor quality[38,39]) examined the utility of the FPS, Visual Analogue Scale (VAS), Pain Intensity Scale (PIS),[39,40] and the Philadelphia Geriatric PIS.[36,37] The completion rates of the FPS, VAS and PIS were between 53-67% for people with largely moderate to severe dementia (Mini Mental State Examination (MMSE) of 15.6, ± 5.9 SD; MMSE of 15.7, ± 5.9 SD).[38,39] Two studies considered the Philadelphia Geriatric PIS and results show it was predictive of negative psychosocial events at 4 months follow up,[36] and identified a greater percentage of pain than reported in the medical records using the NRS, VDS, or FPS (94% vs 36%, respectively).[37]

3.2.2 Informant pain ratings

In total, seven studies (4 fair,[40,41,42,43] and 3 poor quality[39,44,45]) investigated informant-pain ratings of pain for community-dwelling people with dementia using a variety of tools (VDS,[40,43,44] EQ5D,[41,42] the Philadelphia Geriatric PIS,[45] FPS, VAS, PIS[39]). Five of these studies compared the percentage of self-reported and informant-reported pain for community-dwelling people with dementia.[40-44] Caregivers reported pain presence in the person with dementia more frequently than the person with dementia themselves (see Figure 2). In the three studies investigating the congruence between people with dementia and their caregiver's rating of pain an inter-rater reliability ranged from 0.25 to 0.34,[39,41,42] with an average agreement of 58.6% in the two fair quality studies (range 58.2% to 59%).[42,43]

[Insert Figure 2]

3.2.3 Observation of pain behaviours

One poor quality study investigated the Hospice Approach Discomfort Scale, a rating tool for observation of behaviours.[39] Such tools aim to identify pain using non-verbal cues (e.g. behaviour, facial expression, body language).[46] Poor correlations between the Hospice Approach Discomfort Scale and self-reported pain scales (FPS, VAS, and PIS) were reported; however, the author did not provide statistical evidence to support the findings and therefore estimations of concordance cannot be reported.

3.3 Treatments for pain

27 papers provided an overview of treatments for pain for community-dwelling people with dementia. 22 papers (3 good,[47,48,49] 16 fair,[19,37,40,41,50-53,55-61] 3 poor quality[38,44,62]) provided an overview of the pain treatments used by people with dementia.

3.3.1 An overview of analgesic use

Two papers investigated the use of analgesics for community-dwelling people with dementia over time, irrespective of their analgesic potency.[47,55] Hamina et al[55] examined analgesic use during the first 180 days after dementia diagnosis, stratified by the year of diagnosis (from 2005 to 2011). People diagnosed with dementia in 2011 were 2.3 times more likely to be prescribed analgesic medication during the first 180 days after diagnosis than people diagnosed with dementia in 2005. Alternatively, Gilmartin et al[47] examined analgesic use from the time of dementia diagnosis, to five years after dementia diagnosis. Analgesic use remained largely consistent. These fair and good quality studies point more strongly towards changes with prescribing practices over time (cohort effect), irrespective of age and dementia severity.

11 papers reported an average 41.4% (range 24.7% to 63%) of people with dementia used analgesic medication.[19,37,38,40,50,51,54,55,58,60,62] Four papers found that 47.7% (range 30.3% to 68%) of people with dementia reporting pain did not use analgesic medication.[41,44,57,59] When exploring the prevalence of

analgesic use by community-dwelling people with dementia compared to a reference group, four papers (fair quality) found a mixed trend, with community-dwelling people with dementia having a lower[51,52] or similar[19,55] prevalence of analgesic medication compared to community-dwelling older adults without dementia.

3.3.2 Categories of Analgesics prescribed

3.3.2.1 Paracetamol

Paracetamol was used by an average 23.9% (range 12% to 32%) of people with dementia.[19,38,40,55] The amount of paracetamol used by community-dwelling people with dementia (with the exception of Hamina et al[55]) included over-the-counter and prescribed paracetamol. Evidence suggests community-dwelling people with dementia use paracetamol more commonly than community-dwelling people without dementia.[19,55]

Longitudinal research suggests that the use of paracetamol increased from the first year after dementia diagnosis to five years post-diagnosis.[47]

3.3.2.2 Nonsteroidal anti-inflammatory drugs (NSAIDs)

Across all studies the combined prevalence of over-the-counter and prescribed NSAID use was 12% (range 5.9% to 21%).[19,38,40,55] Lower rates of NSAID use[19] and prescriptions[55] was found for community-dwelling people with dementia compared to community-dwelling people without dementia (5.9% vs 12%, respectively),[19] and matched controls (13.2% vs 17.3%, respectively).[55]

NSAID use decreased from the first year after dementia diagnosis to five years post-diagnosis.[47] Additionally, the amount of NSAIDs prescribed during the first 180 days after dementia diagnosis also decreased each year from 2005 to 2011 for community-dwelling people with dementia,[55] suggesting a change in the practice of prescribing NSAID medication over time, irrespective of age and dementia progression.

3.3.2.3 Opioids

The prevalence of opioid use for community-dwelling people with dementia was on average 14.3% (range 7.1% to 27.5%).[19,38,40,48-50,53,55,56] Three studies (two fair quality,[55,56] and one good quality[48]) show that community-dwelling people with dementia were prescribed less opioids than age, sex, and region of residence matched controls without dementia. However, two studies[19,53] (both of fair quality) showed that more community-dwelling people with dementia used[19] or were prescribed[53] opioid medication compared to community-dwelling people without dementia (see Figure 3).

The use of opioids for community-dwelling people with dementia was relatively consistent from the first year after dementia diagnosis to five years post-diagnosis.[47] However, the amount of opioids prescribed during the first 180 days of dementia diagnosis increased each year from 2005 to 2011,[55] with those diagnosed in 2011 being 3.7 times more likely to be prescribed an opioid during the first 180 days after dementia diagnosis compared to those diagnosed in 2005.

[Insert figure 3]

When opioid use was stratified further based on strength defined by the World Health Organisation's (WHO) Analgesic Ladder, an average 9.8% (range 2.7% to 16.8%) of people with dementia were prescribed weak opioids, whereas the proportion prescribed strong opioids was 5.3% (range 0.95 to 17.4%).[37,53,55,56] The annual prevalence of strong opioid use was higher among community-dwelling people with dementia compared to the reference group.[53,56] Community-dwelling people with dementia had a 1.44 higher odds of being prescribed fentanyl than matched controls,[56] and a two times higher odds than a comparison group without dementia.[53] Additionally, community-dwelling people with dementia had a two times higher odds of being prescribed buprenorphine than community-dwelling people without dementia.[53]

3.4. The effectiveness of treatments for pain

Five papers investigated the effectiveness of treatments for pain for community-dwelling people with dementia by measuring the result of an intervention upon pain assessment scores (1 fair quality,[63] 4 poor quality[45,62,64,65]). Two papers investigated analgesic treatments[63,64] with three investigating a non-pharmacological treatment/intervention for pain.[45,62,65]

Elliot and Horgas[64] investigated the effectiveness of scheduled paracetamol in reducing pain behaviours (e.g. rubbing, grimacing, and sighing) among those with musculoskeletal pain. Observed pain behaviours were lower in treatment phases than during baseline phases. Benedetti et al[63] found no difference in pain scores between an expected or unexpected application of 1% lidocaine during the insertion of a needle. However, the difference between the open applications decreased between baseline and follow up.

One study investigated the effectiveness of a non-pharmacological music intervention upon pain for this population.[65] Informal-caregivers assessed pain 30 minutes before, during, and after listening to music. Many comparisons indicated non-significant findings; however, pain was significantly lower after listening to music than before listening to music. Two studies[45,62] investigated the effectiveness of psychosocial interventions with mixed efficacy (see Table 3).

4 Discussion

This review provides an overview of the current evidence on both pain assessment and pain treatment for community-dwelling people with dementia. These two areas will be discussed in turn, contextualised by contrasting with comparative population groups, and considering implications for practice, research and policy.

Pain assessment

The first aim of this review was to synthesise evidence on the use of pain assessment tools and methods, and their utility for community-dwelling people with dementia. A large proportion of those who have moderate to severe dementia were unable to complete a self-report pain instrument,[38,39] suggesting a threshold effect for their efficacy in this population. Such findings are in line with the British Pain Society (BPS) recommendations that encourage the use of self-report measures for people with dementia (irrespective of their degree of cognitive ability); however certain adaptations (e.g. simplified language and large fonts) may be required, especially for those with moderate and severe cognitive impairment.[7,66] Overall, whilst self-report pain assessments can be used in community-dwelling people with dementia, a reliance on self-report methods in isolation is not recommended, especially for people with moderate-to-severe dementia.[7]

Informant-ratings by informal caregivers show a discrepancy compared to the person with dementia's self-report rating of pain, with caregivers reporting the person with dementia to be in pain more commonly than the person themselves. Interestingly in nursing home settings, similarities across informant-ratings are evident,[68] however nurses and nursing assistants rate people with dementia to experience less pain than self-ratings.[69] Such findings contradict findings from this review, indicating potential differences dependant on the environment of care. Certainly informant "over and under" estimations of pain are likely to have negative implications for treatment of pain for people with dementia.[14,18] Studies investigating informant-ratings of pain included in this review used self-report instruments (such as the VDS and EQ5D) to compare informant and self-reports of pain. Tools created specifically for caregiver informant-use (e.g. Pain Assessment for the Dementing Elderly; PADE,[69] Pain Assessment in Noncommunicative Elderly Persons; PAINE,[70] Abbey Pain Scale[71]) are yet to be tested, or validated within community-dwelling people with dementia.

This review identified only one, low quality study examining a behavioural observation pain assessment tool and the conclusions from this study suggest a poor correlation with self-report methods. Previous reviews have evaluated behavioural observation pain tools for people with

dementia residing in formal care settings.[26,45,72,73] These reviews suggest that behavioural observation pain tools hold promise to identify pain for people with dementia (e.g. PAINAD, PACSLAC, DOLOPLUS2 and ECPA).[45,74] However further psychometric development and testing is essential.[26,46] Behavioural observation tools may be suitable for community-dwelling people with dementia however, the lack of testing and development in this setting, as illuminated by this review, hinders the ability to provide definitive conclusions.

Treatment of pain

In the second aim of this review, the synthesis of evidence on the use of pain treatments for community-dwelling people with dementia indicates that community-dwelling people with dementia had less or similar analgesic prescriptions than comparator groups. This mixed evidence may be explained by the varying healthcare organisation and funding models across each region (USA, Finland, and Sweden). In nursing home settings, the large majority of evidence to date has found people with dementia are prescribed less pain medication than their matched controls.[14,75,76]

When analgesic medications were stratified into therapeutic classifications, community-dwelling people with dementia more commonly used paracetamol compared to community-dwelling older adults without dementia, with similar findings also evident in nursing home settings.[6,19,20] The notable preference towards paracetamol is consistent with recommendations suggesting paracetamol as a first-line analgesic treatment.[23,77] The recent focus of pain in people with dementia may have contributed to increased paracetamol use, as an attempt to provide adequate treatment for this vulnerable population.

This review found that NSAID prescribing is lower for people with dementia compared to those without a dementia diagnosis, and that NSAID use decreased over time for people with dementia. The findings from this review reflect National Institute for Health and Care Excellence (NICE) guidelines (2015)[78] that advises that NSAIDs should be prescribed with caution for older adults due to the associated risks of gastrointestinal bleeding/perforation, renal dysfunction, and cardiovascular events,[79,80] and only if alternative safer treatments have not provided sufficient pain relief.[81-83] Similar trends in NSAID use are also evident for people with dementia living nursing home settings.[84] Cognitive impairment and certain vascular-based types of dementia may be perceived as an additional risk factor for NSAID treatment and may contribute to caution in prescription. The reduction of NSAID prescriptions may have contributed to the increased use of paracetamol as a compensatory treatment.[19]

This review identified three studies[48,55,56] that found less community-dwelling people with dementia were prescribed opioids, however, two studies[19,53] found that more community-dwelling people with dementia used opioid medication compared to comparator groups without dementia. Differences between the studies may contribute to the unclear findings; opioid prescriptions were identified at the time of the research interview,[19] during a six-month period of dementia diagnosis,[55] or a one-year period (during 2005).[56] A much larger percentage of opioid prescriptions were evident when the length of investigation increased to a 5-year period potentially because of cohort effects.[48] A recent systematic review investigating opioid use for people with dementia (irrespective of residential status) found that they used less opioids than people without cognitive impairment.[85] High quality research to further explore opioid use for community-dwelling people with dementia is essential to determine if the findings align to those found in other residential settings, and to further understand the implications for effective management.

When opioid prescriptions were stratified into weak and strong opioids, this review found that fentanyl and buprenorphine were prescribed more commonly to people with dementia compared to matched controls.[48,53,55] In nursing home settings, research suggests that older adults with cognitive impairment were more likely to receive fentanyl transdermal patch formulations as a first line treatment for pain.[86,87] Fentanyl and buprenorphine may be favoured for people with dementia due to the benefits of

transdermal patch formulations for those with swallowing difficulties, impaired gastrointestinal function, and/or a reduced analgesic compliance.[85,88]

Finally, this review aimed to evaluate the effectiveness of pharmacological and non-pharmacological treatments; however, evidence was limited and low quality. Scheduled paracetamol treatment reduced pain scores for people with dementia. Such findings are comparable to larger trials conducting in nursing home settings.[21,22] Additionally, experimental evidence suggests people with dementia may require more analgesia to reach the appropriate level of pain relief, questioning the current efficacy of analgesic treatment for people with dementia based on routine prescribing regimes,[63] however more research is essential prior to confirm this finding. This review identified only poor quality papers investigated the efficacy of non-pharmacological treatments (including music, and psychosocial interventions) for pain in community-dwelling people with dementia. Other systematic reviews report that non-pharmacological treatments (e.g. music therapy, Reiki, reflexology, person-centred showering or bathing) can be effective in reducing pain for people with dementia living in formal care.[89]

4.3 Strengths and limitations

This review has notable strengths. It is the first to provide a broad overview of the evidence on pain assessment and treatment for pain for community-dwelling people with dementia. The search strategy developed in collaboration with experienced information specialists is comprehensive with extensive supplementary searches. This review reports on the quality of evidence from the included studies, which has highlighted a low level of quality evidence on this topic within community-dwelling populations of those with dementia.

There are, however, limitations that are important to consider. Some studies[90-95] provided information on pain assessment or pain treatment for people with cognitive impairment, using standardised instruments such as the MMSE, however these studies did not provide sufficient information to confirm that participants had a diagnosis of dementia and were therefore not included in the review. Finally, the conclusions of this review need to be contextualised within the limited research to date; 12 studies actively recruited participants with mild-to-moderate, or newly diagnosed dementias, with many more recruiting an insufficient number of participants with severe dementia. Therefore, the extent of evidence on more severely affected community-dwelling people with dementia is limited and more evidence is required in this sub-population.

4.4 Clinical implications

Due to the minimal high quality research to date, this review was unable to provide definitive conclusions regarding a pain assessment tool or method to recommend for use with community-dwelling people with dementia. Clinicians should therefore adopt a multidimensional approach using “a hierarchy of pain assessment techniques” including self-report assessments, pain history information, physical examinations, informant-based ratings, and observation of pain behaviours, in line with previous recommendations.[96] Reliance on one method alone may lead to suboptimal assessment and treatment.

In terms of analgesic use, adverse effects, comorbidities, and polypharmacy are common in older adults, with the added complexity of cognitive impairments associated with dementia and the already outlined challenges in pain assessment. Due to these complexities, regular and structured medication reviews are needed to assess the use, efficacy, and side effects of analgesic prescriptions, especially so as changes to cognitive ability are evident over the course of the disease. Care is particularly needed when new medications, particularly transdermal analgesics that are initiated to manage pain,[97] to balance the risk of adverse drug reactions against the ease of transdermal patch administration of opioids.[56] In conjunction with pharmacological strategies, prescribing clinicians should consider the use of non-pharmacological strategies to minimise drug related adverse events.

4.5 Research Implications

In regard to pain assessment, research comparing multiple pain assessment instruments for a range of dementia severities using a clear, and pre-defined protocol within a community sample is required. High quality evidence is essential to assess the psychometric properties and clinical utility of pain assessment instruments (including self- and informant-based measures, and behavioural observation pain tools) for community-dwelling people with dementia.

Future research investigating treatments for pain should stratify analgesia by therapeutic classification, with a focus towards high quality longitudinal evidence to encompass the person with dementia's progression. Such evidence is essential to provide a basis for future randomised control trials, alike to those conducted in nursing home settings.[21,22,98]

5 Conclusions

This review identifies a dearth of high quality studies exploring pain assessment and/or treatment for community-dwelling people with dementia, not least into non-pharmacological interventions. The consequences of this lack of evidence, given the current and projected prevalence of the disease, are very serious and require urgent redress. In the meantime, clinicians should adopt a patient and caregiver centred, multi-dimensional, longitudinal approach to pain assessment and treatment in this population.

Acknowledgements:

We thank the systematic review team based at the Research Institute for Primary Care and Health Sciences for their advice on the protocol and search strategies. We would also like to thank members of the Patient and Public Involvement group for their invaluable contribution to this project.

References

1. United Nations. World Population Ageing 2015. http://www.un.org/en/development/desa/population/publications/pdf/ageing/WPA2015_Report.pdf Accessed February, 6, 2018.
2. He W, Goodkind D, Kowal P. International population reports: An aging world 2015. US Census Bureau. 2016:P95.
3. Livingston G, Sommerlad A, Orgeta V, et al. Dementia prevention, intervention, and care. The Lancet 2017;390:2673-2734.
4. Prince MJ. World Alzheimer Report 2015: the global impact of dementia: an analysis of prevalence, incidence, cost and trends. Alzheimer's Disease International; 2015. https://www.alz.co.uk/research/WorldAlzheimerReport2015.pdf Accessed March 2, 2018.
5. Cimas M, Ayala A, Sanz B, et al. Chronic musculoskeletal pain in European older adults: Cross-national and gender differences. Eur J Pain 2017;22(2):333-345. doi: 10.1002/ejp.1123.
6. Tan EC, Jokanovic N, Koponen MP, Thomas D, Hilmer SN, Bell JS. Prevalence of analgesic use and pain in people with and without dementia or cognitive impairment in aged care facilities: a systematic review and meta-analysis. Curr Clin Pharmacol. 2015; 1(3):194-203.
7. Hadjistavropoulos T, Herr K, Prkachin KM, et al. Pain assessment in elderly adults with dementia. The Lancet Neurology. 2014;13(12):1216-27.
8. Zwakhalen SM. Pain in Dementia. In: Schüssler S, Lohrmann C, editors. Dementia in Nursing Homes. Cham: Springer International Publishing; 2017. p. 77-87.
9. Barber JB, Gibson SJ. Treatment of chronic non-malignant pain in the elderly. Drug safety. 2009 Jun 1;32(6):457-74.
10. Black W, Almeida OP. A systematic review of the association between the behavioral and psychological symptoms of dementia and burden of care. Int Psychogeriatr 2004;16(3):295-315.
11. Schoenmakers B, Buntinx F, Devroey D, Van Casteren V, DeLepeleire J. The process of definitive institutionalization of community dwelling demented vs non demented elderly: data obtained from a network of sentinel general practitioners. Int J Geriatr Psychiatry 2009;24(5):523-31.
12. Parmar J, Dobbs B, McKay R, et al. Diagnosis and management of dementia in primary care: exploratory study. Can Fam Physician. 2014 May;60(5):457-65.
13. Bauer U, Pitzer S, Schreier MM, Osterbrink J, Alzner R, Iglseder B. Pain treatment for nursing home residents differs according to cognitive state–a cross-sectional study. BMC geriatrics 2016;16(1):124.
14. Neumann-Podczaska A, Nowak T, Suwalska A, Łojko D, Krzymińska-Siemaszko R, Kozak-Szkopek E, Wieczorowska-Tobis K. Analgesic use among nursing homes residents, with and without dementia, in Poland. Clin Interv Aging 2016;11:335.
15. Morrison RS, Siu AL. A comparison of pain and its treatment in advanced dementia and cognitively intact patients with hip fracture. J Pain Symptom Manage 2000;19(4):240-248.
16. Morrison RS, Magaziner J, Gilbert M, et al. Relationship between pain and opioid analgesics on the development of delirium following hip fracture. The Journals of Gerontology Series A: Biological Sciences and Medical Sciences 2003;58(1):76-81.
17. Forster MC, Pardiwala A, Calthorpe D. Analgesia requirements following hip fracture in the cognitively impaired. Injury 2000;31(6):435-6.
18. Rantala M, Hartikainen S, Kvist T, Kankkunen P. Analgesics in postoperative care in hip fracture patients with dementia–reported by nurses. Journal of clinical nursing. 2014;23(21-22):3095-3106.
19. Haasum Y, Fastbom J, Fratiglioni L, Kåreholt I, Johnell K. Pain treatment in elderly persons with and without dementia. Drugs & aging 2011;28(4):283-293.
20. Lövheim H, Karlsson S, Gustafson Y. The use of central nervous system drugs and analgesics among very old people with and without dementia. Pharmacoepidemiol Drug Saf. 2008;17(9):912-918.
21. Husebo BS, Ballard C, Sandvik R, Nilsen OB, Aarsland D. Efficacy of treating pain to reduce behavioural disturbances in residents of nursing homes with dementia: cluster randomised clinical trial. BMJ 2011;343:d4065. doi: https://doi.org/10.1136/bmj.d4065

22. Husebo BS, Ballard C, Fritze F, Sandvik RK, Aarsland D. Efficacy of pain treatment on mood syndrome in patients with dementia: a randomized clinical trial. Int J Geriatr Psychiatry 2014;29(8):828-836.
23. Corbett A, Husebo B, Malcangio M, et al. Assessment and treatment of pain in people with dementia. Nat Rev Neurol 2012;8(5):264.
24. Schofield P, Clarke A, Faulkner M, Ryan T, Dunham M, Howarth A. Assessment of pain in adults with cognitive impairment: a review of the tools. Int J Disabil Hum Dev 2005;4(2):59-66.
25. Stolee P, Hillier LM, Esbaugh J, Bol N, McKellar L, Gauthier N. Instruments for the assessment of pain in older persons with cognitive impairment. J Am Geriatr Soc 2005;53(2):319-26.
26. Herr K, Bjoro K, Decker S. Tools for assessment of pain in nonverbal older adults with dementia: a state-of-the-science review. J Pain Symptom Manage. 2006 Feb 1;31(2):170-92.
27. Smith M. Pain assessment in nonverbal older adults with advanced dementia. Perspectives in psychiatric care 2005;41(3):99-113.
28. Park J, Castellanos-Brown K, Belcher J. A review of observational pain scales in nonverbal elderly with cognitive impairments. Res Soc Work Pract 2010;20(6):651-664.
29. Qi S, Diane J, Kay D. The psychometric properties, feasibility and utility of behavioural-observation methods in pain assessment of cognitively impaired elderly people in acute and long-term care: A systematic review. JBI Database System Rev Implement Rep 2012;10(17):977-1085.
30. Lichtner V, Dowding D, Esterhuizen P et al. Pain assessment for people with dementia: a systematic review of systematic reviews of pain assessment tools. BMC geriatrics 2014;14(1):138.
31. Prince M, Knapp M, Guerchet M, et al. Dementia UK: update. Alzheimer's Society 2014. https://www.alzheimers.org.uk/download/downloads/id/2323/dementia_uk_update.pdf. Accessed March 2, 2018.
32. Cohen-Mansfield J, Lipson S. The utility of pain assessment for analgesic use in persons with dementia. Pain. 2008 Jan 1;134(1-2):16-23.
33. National Heart, Lung, and Blood Institute. Study quality assessment tools. 2014. https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools Accessed December 21 2018
34. Popay J, Roberts H, Sowden A, et al. Guidance on the conduct of narrative synthesis in systematic reviews. A product from the ESRC methods programme Version. 2006;1:b92.
35. Park H, Chun Y, Gang MS. Effects of the Patient-Centered Environment Program on Behavioral and Emotional Problems in Home-Dwelling Patients With Dementia. J Gerontol Nurs 2015;41(12):40-48.
36. Snow AL, Chandler JF, Kunik ME et al. Self-reported pain in persons with dementia predicts subsequent decreased psychosocial functioning. Am J Geriatr Psychiatry 2009;17(10):873-880.
37. Li J, Snow AL, Wilson N, et al. The quality of pain treatment in community-dwelling persons with dementia. Dement Geriatr Cogn Dis Extra 2015;5(3):470-81.
38. Brummel-Smith K, London MR, Drew N, Krulewitch H, Singer C, Hanson L. Outcomes of pain in frail older adults with dementia. J Am Geriatr Soc 2002;50(11):1847-1851.
39. Krulewitch H, London MR, Skakel VJ, Lundstedt GJ, Thomason H, Brummel-Smith K. Assessment of pain in cognitively impaired older adults: a comparison of pain assessment tools and their use by nonprofessional caregivers. J Am Geriatr Soc 2000;48(12):1607-1611.
40. Barry HE, Parsons C, Passmore AP, Hughes CM. Exploring the prevalence of and factors associated with pain: a cross-sectional study of community-dwelling people with dementia. Health Soc Care Community 2016;24(3):270-282.
41. Jensen-Dahm C, Vogel A, Waldorff FB, Waldemar G. Discrepancy Between Self-and Proxy-Rated Pain in Alzheimer's Disease: Results from the Danish Alzheimer Intervention Study. J. Am Geriatr Soc 2012;60(7):1274-1278.
42. Orgeta V, Orrell M, Edwards RT, Hounsome B, Woods B. Self-and carer-rated pain in people with dementia: Influences of pain in carers. J Pain Symptom Manage 2015;49(6):1042-1049.
43. Shega JW, Hougham GW, Stocking CB, Cox-Hayley D, Sachs GA. Pain in community-dwelling persons with dementia: frequency, intensity, and congruence between patient and caregiver report. J Pain Symptom Manage 2004;28(6):585-592.

44. Hunt LJ, Covinsky KE, Yaffe K, Stephens CE, Miao Y, Boscardin WJ, Smith AK. Pain in Community-Dwelling Older Adults with Dementia: Results from the National Health and Aging Trends Study. J Am Geriatr Soc 2015;63(8):1503-1511.
45. Kunik ME, Snow AL, Wilson N, Amspoker AB, Sansgiry S, Morgan RO, Ying J, Hersch G, Stanley MA. Teaching caregivers of persons with dementia to address pain. The American Journal of Geriatric Psychiatry. 2017 Feb 1;25(2):144-54.
46. Zwakhalen SM, Hamers JP, Abu-Saad HH, Berger MP. Pain in elderly people with severe dementia: a systematic review of behavioural pain assessment tools. BMC geriatrics 2006;6(1):3. https://doi.org/10.1186/1471-2318-6-3
47. Gilmartin JF, Väätäinen S, Törmälehto S, et al. Depressive symptoms are associated with analgesic use in people with Alzheimer's disease: Kuopio Alsova study. PloS one 2015;17;10(2):e0117926.
48. Hamina A, Taipale H, Tanskanen A, Tolppanen AM, Karttunen N, Pylkkänen L, Tiihonen J, Hartikainen S. Long-term use of opioids for nonmalignant pain among community-dwelling persons with and without Alzheimer disease in Finland: a nationwide register-based study. Pain 2017;158(2):252-260.
49. Hamina A, Lavikainen P, Tanskanen A, Tolppanen AM, Tiihonen J, Hartikainen S, Taipale H. Impact of opioid initiation on antipsychotic and benzodiazepine and related drug use among persons with Alzheimer's disease. International psychogeriatrics. 2018 Mar:1-0.
50. Hartikainen SA, Mäntyselkä PT, Louhivuori-Laako KA, Sulkava RO. Balancing pain and analgesic treatment in the home-dwelling elderly. Ann Pharmacother 2005;39(1):11-16.
51. Mäntyselkä P, Hartikainen S, Louhivuori-Laako K, Sulkava R. Effects of dementia on perceived daily pain in home-dwelling elderly people: a population-based study. Age ageing 2004;33(5):496-499.
52. Schmader KE, Hanlon JT, Fillenbaum GG, Huber M, Pieper C, Horner R. Medication use patterns among demented, cognitively impaired and cognitively intact community-dwelling elderly people. Age Ageing 1998;27(4):493-501.
53. Jensen-Dahm C, Gasse C, Astrup A, Mortensen PB, Waldemar G. Frequent use of opioids in patients with dementia and nursing home residents: A study of the entire elderly population of Denmark. Alzheimers Dement 2015;11(6):691-699.
54. Gallini A, Gardette V, Vellas B, Lapeyre-Mestre M, Andrieu S, Brefel-Courbon C. Persistent use of analgesic medications in mild-to-moderate Alzheimer's disease. Drugs & aging. 2013;30(6):439-445.
55. Hamina A, Taipale H, Tanskanen A, Tolppanen AM, Tiihonen J, Hartikainen S. Differences in analgesic use in community-dwelling persons with and without Alzheimer's disease. Eur J Pain 2016;21(4):658-667.
56. Bell JS, Laitinen ML, Lavikainen P, Lönnroos E, Uosukainen H, Hartikainen S. Use of strong opioids among community-dwelling persons with and without Alzheimer's disease in Finland. Pain 2011;152(3):543-547.
57. Thakur ER, Amspoker AB, Sansgiry S, et al. Pain Among Community-Dwelling Older Adults with Dementia: Factors Associated with Undertreatment. Pain Medicine 2016;18(8):1476-1484.
58. Breland JY, Barrera TL, Snow AL, Sansgiry S, Stanley MA, Wilson N, Amspoker AB, Kunik ME. Correlates of pain intensity in community-dwelling individuals with mild to moderate dementia. Am J Alzheimer's Dis Other Dement 2015;30(3):320-325.
59. Shega JW, Hougham GW, Stocking CB, Cox-Hayley D, Sachs GA. Management of Noncancer Pain in Community-Dwelling Persons with Dementia. J Am Geriatr Soc 2006;54(12):1892-1897.
60. Regier NG, Gitlin LN. Dementia-related restlessness: relationship to characteristics of persons with dementia and family caregivers. International journal of geriatric psychiatry. 2018 Jan;33(1):185-92. 22:4, 458-467, DOI: 10.1080/13607863.2017.1286451
61. Grace EL, Allen RS, Ivey K, Knapp, SM, Burgio LD. Racial and ethnic differences in psychotropic medication use among community- dwelling persons with dementia in the United States. Aging & Mental Health. 2018:22(4): 458-467, DOI: 10.1080/13607863.2017.1286451
62. Nakanishi M, Hirooka K, Imai Y, Inoue S, Yukari Y, Katayama C, Miyamoto Y, Shindo Y, Ueno H, Toya J, Takano Y. Dementia Care Competence Among Care Professionals and Reduced

Challenging Behavior of Home-Dwelling Persons with Dementia: A Pre-and Post-Intervention Data Analysis. Journal of Alzheimer's Disease. 2018 Jun 8(Preprint):1-9.
63. Benedetti F, Arduino C, Costa S, Vighetti S, Tarenzi L, Rainero I, Asteggiano G. Loss of expectation-related mechanisms in Alzheimer's disease makes analgesic therapies less effective. Pain 2006;121(1-2):133-144.
64. Elliott AF, Horgas AL. Effects of an analgesic trial in reducing pain behaviors in community-dwelling older adults with dementia. Nursing research 2009;58(2):140-145.
65. Park H. Effect of music on pain for home-dwelling persons with dementia. Pain Manag Nurs 2010;11(3):141-147.
66. British Pain Society and British Geriatrics Society. The assessment of pain in older people. 2007. https://www.britishpainsociety.org/static/uploads/resources/files/book_pain_older_people.pdf Accessed December 14, 2018.
67. Cohen-Mansfield J. Relatives' assessment of pain in cognitively impaired nursing home residents. Journal of Pain and Symptom Management. 2002 Dec 1;24(6):562-71.
68. Chen YH, Lin LC, Watson R. Validating nurses' and nursing assistants' report of assessing pain in older people with dementia. J Clin Nurs 2010;19(1-2):42-52.
69. Villanueva MR, Smith TL, Erickson JS, Lee AC, Singer CM. Pain assessment for the dementing elderly (PADE): reliability and validity of a new measure. Journal of the American Medical Directors Association. 2003 Jan 1;4(1):1-8.
70. Cohen-Mansfield J. Pain assessment in noncommunicative elderly persons—PAINE. The Clinical journal of pain. 2006 Jul 1;22(6):569-75.
71. Abbey J, Piller N, Bellis AD, Esterman A, Parker D, Giles L, Lowcay B. The Abbey pain scale: a 1-minute numerical indicator for people with end-stage dementia. International journal of palliative nursing. 2004 Jan;10(1):6-13.
72. Hadjistavropoulos T, Herr K, Turk DC, Fine PG, Dworkin RH, Helme R, Jackson K, Parmelee PA, Rudy TE, Beattie BL, Chibnall JT. An interdisciplinary expert consensus statement on assessment of pain in older persons. The Clinical journal of pain. 2007 Jan 1;23:S1-43.
73. Van Herk R, Van Dijk M, Baar FP, Tibboel D, De Wit R. Observation scales for pain assessment in older adults with cognitive impairments or communication difficulties. Nursing Research. 2007 Jan 1;56(1):34-43.
74. Lautenbacher S, Kunz M. Facial pain expression in dementia: a review of the experimental and clinical evidence. Current Alzheimer Research. 2017 May 1;14(5):501-5.
75. Cornali C, Franzoni S, Gatti S, Trabucchi M. Diagnosis of chronic pain caused by osteoarthritis and prescription of analgesics in patients with cognitive impairment. J Am Med Dir Assoc 2006;7(1):1-5.
76. Nygaard HA, Jarland M. Are nursing home patients with dementia diagnosis at increased risk for inadequate pain treatment?. Int J Geriatr Psychiatry 2005;20(8):730-737.
77. NICE. Analgesia - mild-to-moderate pain. Scenario: Paracetamol. 2015 accessed December 14, 2018. https://cks.nice.org.uk/analgesia-mild-to-moderate-pain#!scenario:1
78. NICE. NSAIDs - prescribing issues. 2015. https://cks.nice.org.uk/nsaids-prescribing-issues#!scenario. Accessed December 14, 2018
79. Cavalieri TA. Managing pain in geriatric patients. J Am Osteopath Assoc 2007;107(Supplement 4): ES10-ES16.
80. MHRA. Cox-2 selective inhibitors and non-steroidal anti-inflammatory drugs (NSAIDs): Cardiovascular safety 2015 https://cks.nice.org.uk/nsaids-prescribing-issues#!scenario. Accessed December 14, 2018.
81. Bedson J, Belcher J, Martino OI, et al. The effectiveness of national guidance in changing analgesic prescribing in primary care from 2002 to 2009: an observational database study. Eur J Pain. 2013;17(3):434-443.
82. MHRA. Non-steroidal anti-inflammatory drugs (NSAIDs): reminder on renal failure and impairment 2009 https://www.gov.uk/drug-safety-update/non-steroidal-anti-inflammatory-drugs-nsaids-reminder-on-renal-failure-and-impairment. Accessed December 14, 2018.
83. Abdulla A, Bone M, Adams N, Elliott AM, Jones D, Knaggs R, Martin D, Sampson EL, Schofield P. Evidence-based clinical practice guidelines on management of pain in older people. Age Ageing 2013;42(2):151-153

84. Sandvik R, Selbaek G, Kirkevold O, Husebo BS, Aarsland D. Analgesic prescribing patterns in Norwegian nursing homes from 2000 to 2011: trend analyses of four data samples. Age ageing. 2016;45(1):54-60.
85. Griffioen C, G Willems E, S Husebo B, P Achterberg W. Prevalence of the use of opioids for treatment of pain in persons with a cognitive impairment compared with cognitively intact persons: a systematic review. Current Alzheimer Research. 2017 May 1;14(5):512-22.
86. Dosa DM, Dore DD, Mor V, Teno JM. Frequency of long-acting opioid analgesic initiation in opioid-naive nursing home residents. J Pain Symptom Manage 2009;38(4):515-521.
87. Fain KM, Castillo-Salgado C, Dore DD, Segal JB, Zullo AR, Alexander GC. Inappropriate fentanyl prescribing among nursing home residents in the United States.
88. Pergolizzi J, Böger RH, Budd K, et al. Opioids and the management of chronic severe pain in the elderly: consensus statement of an International Expert Panel with focus on the six clinically most often used World Health Organization Step III opioids (buprenorphine, fentanyl, hydromorphone, methadone, morphine, oxycodone). Pain Pract 2008;8(4):287-313.
89. Pieper MJ, van Dalen-Kok AH, Francke AL, van der Steen JT, Scherder EJ, Husebø BS, Achterberg WP. Interventions targeting pain or behaviour in dementia: a systematic review. Ageing research reviews. 2013 Sep 1;12(4):1042-55.
90. Maxwell CJ, Dalby DM, Slater M, Patten SB, Hogan DB, Eliasziw M, Hirdes JP. The prevalence and management of current daily pain among older home care clients. Pain 2008;138(1):208-216.
91. Hanlon JT, Landerman LR, Wall JR WE, et al. Is medication use by community-dwelling elderly people influenced by cognitive function?. Age Ageing 1996;25(3):190-196.
92. Taylor LJ, Herr K. Pain intensity assessment: a comparison of selected pain intensity scales for use in cognitively intact and cognitively impaired African American older adults. Pain Manag Nurs 2003;4(2):87-95.
93. Taylor LJ, Harris J, Epps CD, Herr K. Psychometric evaluation of selected pain intensity scales for use with cognitively impaired and cognitively intact older adults. Rehabil Nurs 2005;30(2):55-61.
94. Westerbotn M, Hillerås P, Fastbom J, Agüero-Torres H. Pain reporting by very old Swedish community dwellers: the role of cognition and function. Aging Clin Exp Res 2008;20(1):40-46.
95. Pokela N, Bell JS, Lihavainen K, Sulkava R, Hartikainen S. Analgesic use among community-dwelling people aged 75 years and older: a population-based interview study. Am J Geriatr Pharmacother 2010;8(3):233-244.
96. Herr K, Coyne PJ, McCaffery M, Manworren R, Merkel S. Pain assessment in the patient unable to self-report: position statement with clinical practice recommendations. Pain Manag Nurs 2011;12(4):230-250.
97. Bedson J, Chen Y, Hayward RA, et al. Trends in long-term opioid prescribing in primary care patients with musculoskeletal conditions: an observational database study. Pain 2016;157(7):1525.
98. Husebo BS, Achterberg W, Flo E. Identifying and managing pain in people with Alzheimer's disease and other types of dementia: a systematic review. CNS drugs. 2016;30(6):481-497.
99. Hartikainen, S., Mäntyselkä, P., Louhivuori-Laako, K., Enlund, H., & Sulkava, R. (2005). Concomitant use of analgesics and psychotropics in home-dwelling elderly people-Kuopio 75+ study. *British journal of clinical pharmacology*, *60*(3), 306-310.
100. Shega JW, Hougham GW, Stocking CB, Cox-Hayley D, Sachs GA. Factors associated with self-and caregiver report of pain among community-dwelling persons with dementia. Journal of palliative medicine. 2005 Jun 1;8(3):567-75.

Table 1 Summary of pain assessment studies

Author	**Orgeta et al[42]**	**Shega et al[43,100]**	**Jensen-Dahm et al[41]**	**Breland et al[58]**	**Snow et al[36]**
Sub-theme	Informant rating	Informant rating	Informant rating	Self-report	Self-report
Design	Cross-sectional	Cross-sectional	Cross-sectional	Cross-sectional	Cohort
Origin	USA	USA	Denmark	USA	USA
Diagnosis	Dementia	Dementia	AD or DLB	Dementia	Dementia
n (reference/control)	488	115¶	321¶	136	171¶
Quality	Fair	Fair	Fair	Fair	Good
Pain assessment tool	EQ5D	VDS	EQ5D	PGC PIS	PGC PIS
Completion rate %	-	-	-	-	-
PWD (caregivers) % [*p*]	45 (59) [*p*<.001]	32 (53)	32.9 (52)	-	-
Informant agreement	58.2% Kappa = 0.25	59% congruent 40% over report 13% under report	Kappa = 0.34 (X^2 = 71.7, df= 4; *p*<.001)	-	-
Convergence with alternative pain assessment	-	-	-	-	-
Predictive validity	-	-	-	Pain diagnosis in previous year (β=.20, t_{132}=2.17, *p*<.05)	Increased depression (z=2.70) agitation (z= 2.33) decreased pleasant events (z=-2.38)

Table 1 cont. Summary of pain assessment studies

Author	**Barry et al[40]**	**Li et al[37]**	**Brummel-Smith et al[38]**	**Krulewitch et al[39]**	**Hunt et al[44]**	**Kunik et al[45]**
Sub-theme	Informant rating	Self-report	Self-report	Self-report Informant rating Behavioural observation	Informant rating	Informant rating
Design	Cross-sectional	Cross-sectional	Cross-sectional	Cross-sectional	Cross-sectional	Intervention baseline
Origin	Ireland	USA	USA	USA	USA	USA
Diagnosis	Dementia	Dementia	Dementia	Dementia	Dementia	Dementia
n (reference/control)	75†	203	154 (255)	156¶	802 (802)	203
Quality	Fair	Fair	Poor	Poor	Poor	Poor
Pain assessment tool	VDS	PGC PIS	FPS, VAS, PIS	FPS, VAS, PIS, HADS	VDS	PGC PIS
Completion rate %	-	-	32.5	PIS, 62; FPS, 53; VAS, 53 33 unable to complete FPS, VAS, or PIS	-	-
PWD (caregivers) prevalence % [*p*]	Pain now - 36 (53.3) [*p*=.033] Average day – 57.3 (70.7) [*p*=.089]	-	-	-	Activity limit 40.1 (46.6) [*p*= .03] Bothersome 62.7 (64.4) [*p*=.59]	-
PWD (caregiver) mean pain score	-	-	-	-	-	Worst pain: 2.93 (3.15) Overall pain: 2.04 (2.24)
Informant agreement	-	-	-	kappa = .32 PIS (*rho*=.452; *p*<.001) VAS (*rho*=.420; *p*<.001) FPS (*rho*=.417; *p*<.001) HADS: NR	-	-
Convergence with alternative pain assessment	-	94% PGC PIS 36.4% medical record	-	-	-	
Predictive validity	-	-	-	-	-	

¶ dyadic paired participants (e.g. person with dementia and their caregiver).

Abbreviations: CI, confidence interval; FPS, faces pain scale; HADS, Hospice Approach Discomfort Scale; IPT, Iowa Pain Thermometer; NR, not reported; NRS, numerical rating scale; OR, odds ratio; PGC, Philadelphia geriatric centre; PIS, pain intensity scale; PWD, people with dementia; VAS, Visual Analogue Scale; VDS, visual descriptor scale.

Table 2 Summary of pharmacological pain treatment studies

Author	**Hartikainen et al[50,99]**	**Mäntyselkä et al[51]**	**Schmader et al[52]**	**Jensen-Dahm et al[41]**	**Jensen-Dahm et al[53]**	**Haasum et al[19]**
Design	Cross-sectional	Cross-sectional	Cross-sectional	Cross-sectional	Cross-sectional	Cross-sectional
Origin	Finland	Finland	USA	Denmark	Denmark	Sweden
Diagnosis	Dementia	Dementia	Dementia	Dementia	Dementia	Dementia
n (reference)	75 (446)	75 (446)	100 (420)	321¶	35,455 (870,645)	119 (2199†, 186‡)
Quality	Fair	Fair	Fair	Fair	Fair	Fair
Analgesic use % (control %)	63	33.3 (47.3)	-	51.5†† 8.3 received >1	-	36 (24.3†, 52.7‡)
Analgesic use, PWD vs control [OR (95% CI)]	-	-	0.54 (0.39 to 0.75)	-	-	Nursing home vs community 1.72 (0.96 to 3.10)§
Paracetamol use % (control %)	58 (paracetamol and NSAID)	-	-	-	-	24.4 (15.4†, 45.2‡)
Paracetamol use vs control [OR (95% CI)]	-	-	-	-	-	Nursing home vs community 2.52 (1.35 to 4.73)§
NSAID use % (control %)	58 (paracetamol and NSAID)	-	-	-	-	5.9 (12†, 3.8‡)
NSAID use vs control [OR (95% CI)]		-	-	-	-	0.32 (0.07 to 1.42)§
Opioid use % (control %)	13	-	-	-	27.5 (16.9) Weak 14.9 (12.4) Strong 17.4 (7.1)	14.3 (8†, 30.1‡)
Opioid use vs control [OR (95% CI)]	-	-	-	-	All 1.27 (1.22 to 1.31); buprenorphine 2.57 (2.41 to 2.74); fentanyl 2.28 (2.12 to 2.46)	Nursing home vs community 2.84 (1.33 to 6.07)§
Non-pharm (%)	-	-	-	-	-	-

Table 2 cont. Summary of pharmacological pain treatment studies

Author	**Brummel-Smith et al[38]**	**Gallini et al[54]**	**Gilmartin et al[47]**	**Hamina et al[48]**	**Hamina et al[55]**	**Barry et al[40]**
Design	Cross-sectional	Cohort, nested case control	Cohort	Cohort	Cohort	Cross-sectional
Origin	USA	France	Finland	Finland	Finland	Northern Ireland
Diagnosis	Dementia	AD	AD	AD	AD	Dementia
n (reference)†	154 (255)	595	236¶	62,074 (62,074)	67,215 (67,215)	75¶
Quality	Poor	Fair	Good	Good	Fair	Fair
Analgesic use % (control %)	49 received >1	26 13 persistent	13.6, 10.6, 13.7, 16.8, 15.3§§	-	34.9 (33.5)	40 20 taking ≥2
Analgesic use, PWD vs control [OR (95% CI)]	-	-	-	-	2011 vs 2005 [2.34 (2.24 to 2.45)]	-
Paracetamol use % (control %)	14	67.5¶¶	5.5, 5.6, 5.4, 13.0, 11.1§§	-	25 (19.1)	32
Paracetamol use vs control [OR (95% CI)]	-	-	-	-	-	-
NSAID use % (control %)	21	31.2¶¶	8.1, 4.0, 7.7, 3.1, 4.1§§	-	13.2 (17.3)	8
NSAID use vs control [OR (95% CI)]	-	-	-	-	2011 vs 2005 [0.73 (0.69 to 0.77)]	-
Opioid use % (control %)	13	36.2¶¶	1.3, 1.5, 3.0, 2.3, 1.4§§	All 21.1 (26.8); Long term 7.2 (8.7)	All 7.1 (8.3); Weak 5.0 (6.9); Buprenorphine 1.4 (0.9); Strong 1.3 (1.1); Fentanyl 0.8 (0.6)	16
Opioid use vs control [OR (95% CI)]	-	-	-	-	2011 vs 2005 [3.78 (3.44 to 4.15)]	-
Non-pharm (%)	-	-	-	-	-	-

Table 2 cont. Summary of pharmacological pain treatment studies

Author	**Bell et al[56]**	**Hunt et al[44]**	**Thakur et al[57]**	**Breland et al[58]**	**Li et al[37]**	**Shega et al[59]**
Design	Cross-sectional	Cross-sectional	Cross-sectional	Cross-sectional	Cross-sectional	Cross-sectional
Origin	Finland	USA	USA	USA	USA	USA
Diagnosis (subtype)	AD	Dementia	Dementia	Dementia	Dementia	Dementia
n (reference)†	28,089 (28,089)	802 (802)	202	136	203	115¶
Quality	Fair	Poor	Fair	Fair	Fair	Fair
Proportion taking analgesic % (control %)	-	69.7††	56††	49	59.7	32†† 15‡‡
Analgesic - pwd vs control [OR (95% CI)]	-	-	-	-	-	-
Paracetamol % (control %)	-	-	-	40 (non-narcotics)	32.5 (paracetamol/NSAID)	19†† 8‡‡
Paracetamol use vs control [OR (95% CI)]	-	-	-	-	-	-
NSAID % (control %)	-	-	-	40 (non-narcotics)	32.5 (paracetamol/NSAID)	8†† 8‡‡
NSAID use vs control [OR (95% CI)]	-	-	-	-		-
Opioid % (control %)	All 3.56 (4.62); Weak 2.68 (3.83); Strong 0.95 (0.76)	-	-	9	Weak 16.8 Strong 1.5	4†† 0‡‡
Opioid vs control [OR (95% CI)]	All 0.77 (0.71 to 0.84); Weak 0.70 (0.64 to 0.77); Strong 1.26 (1.05 to 1.51); Fentanyl 1.44 (1.13 to 1.83).	-	-	-	-	-
Non-pharm (%)	-	-	-	-	Exercise 45.8	-

Table 2 cont. Summary of pharmacological pain treatment studies

Author	**Regier & Gitlin[60]**	**Nakanishi et al[62]**	**Hamina et al[49]**	**Grace et al[61]**
Design	Cross-sectional	Before-after (baseline data)	Cohort	Cross-sectional
Origin	USA	Japan	Finland	USA
Diagnosis (subtype)	Dementia	Dementia	AD	Dementia
n (reference)	596¶	219	24,747 total n 3327 opioid initiators (3325 non-opioid initiators)	543
Quality	Fair	Poor	Good	Fair
Proportion taking analgesic % (control %)	40.1	24.7	-	22 Caucasian 30 African American 17 Latino
Analgesic - pwd vs control [OR (95% CI)]	-	-	-	-
Paracetamol % (control %)	-	-	58.9 (21.5) (non-opioid initiators)	-
Paracetamol use vs control [OR (95% CI)]	-	-	-	-
NSAID % (control %)	-	-	16.4 (3.6) (non-opioid initiators)	-
NSAID use vs control [OR (95% CI)]	-	-	-	-
Opioid % (control %)	-	-	13.44 (total n)	-
Opioid vs control [OR (95% CI)]	-	-	-	-
Non-pharm (%)	-	-	-	-

Abbreviations: AD, Alzheimer's disease; CI, confidence interval; NSAID, Non-Steroid Inflammatory Inhibitors; OR, Odds Ratio; PWD, people with dementia, USA, United States of America

The control/reference group is community-dwelling people without dementia unless noted otherwise. However, for Haasum (2011) community-dwelling people without dementia (†) is labelled regardless for clarification between the multiple reference groups.

† people without dementia living in the community

‡ people with dementia living in a nursing home

§ comparison of nursing home dwelling people with dementia to community-dwelling people with dementia as the reference population.

¶ dyadic paired participants (e.g. person with dementia and their caregiver).

†† analgesic medication in a sample of people with dementia reporting pain

‡‡ analgesic medication in a sample of people with dementia reporting no pain

§§ baseline, year 1, year 2, year 3, year 4, and year 5.

¶¶ percentage of each analgesic in a sample of people with dementia prescribed analgesic medication

Table 3 Studies evaluating the utility and effectiveness of treatments for pain.

Author	**Elliott & Horgas[64]**	**Benedetti et al[63]**	**Park[65]**	**Nakanishi et al[62]**	**Kunik et al[45]**
Design	Before-after ABAB within subjects	Non-RCT	Before-after ABAB within subjects	Before-after	RCT
Sub-theme	Pharmacological	Pharmacological	Non-pharmacological	Non-pharmacological	Non-pharmacological
Origin	USA	Italy	USA	Japan	USA
Quality	Poor	Fair	Poor	Poor	Poor
Diagnosis (subtype)	Dementia	AD	Dementia	Dementia	Dementia
n (reference/ control)	3	38 (16)	15	219	101¶ (102¶)
Pain assessment	Coded pain behaviours	NRS	M-PADE	Abbey Pain Scale	PGC PIS
Intervention	Paracetamol 1.3g every 8hrs during treatment phases	Open-hidden application of 1% lidocaine during insertion of needle	Preferred music initiated 30 minutes prior to peak agitation time.	2-day training course, a web-based tool for ongoing monitoring and assessment for challenging behaviour, and multi-agency discussion meetings for formal caregivers.	6 to 8 weekly sessions of 45-minute home visits targeted to informal caregivers. Improving: caregivers pain recognition, communication, making daily activities pleasant
Follow up	24 day follow up.	1 year	8 week A = Baseline = 3, 4, 7, 8. B = Week 1, 2, 5, 6.	6 months	3, 6, 12 months
Results (A = baseline, B = Intervention)	Ppt 1: 32.1 (A1), 18.6 (B1), 27.5 (A2), 17.5 (B2) Ppt 2: 33 (A1), 22.5 (B2), 31.1 (A2), 20.1 (B2) Ppt 3: 57.8 (A1), 30 (B1), 53.3 (A2), 29.8 (B2).	The effects of the open treatment lowered in AD after 1 year ($t(27) = -5.151$, $p<.001$).	Pain during vs before ($p=.06$) Pain during vs after ($p=.86$). Intervention weeks vs baseline ($p=.22$). Pain after vs before ($t=2.21$; $df=28$; $p<.05$)	Decreased pain after the intervention compared to before ($t(218)=2.63$, $p=.009$). No difference in analgesics after the intervention compared to before ($X^2(1)=2.00$, $p=0.5$).	Decreased pain over time for treatment group (PWD overall pain: $F(3, 412) = 4.59$, $p=.004$. No difference between groups. 64% of caregivers highlighted skills: recognising signs of pain, pain treatment with analgesic or other strategies.

¶ dyadic paired participants (e.g. person with dementia and their caregiver).

USA United States of America, NRS numerical rating scale, AD Alzheimer's Disease, PGC Philadelphia Geriatric Centre, PIS Pain Intensity Scale, PWD person with dementia, M-PADE Pain Assessment in Dementing Elderly, RCT randomised control trial

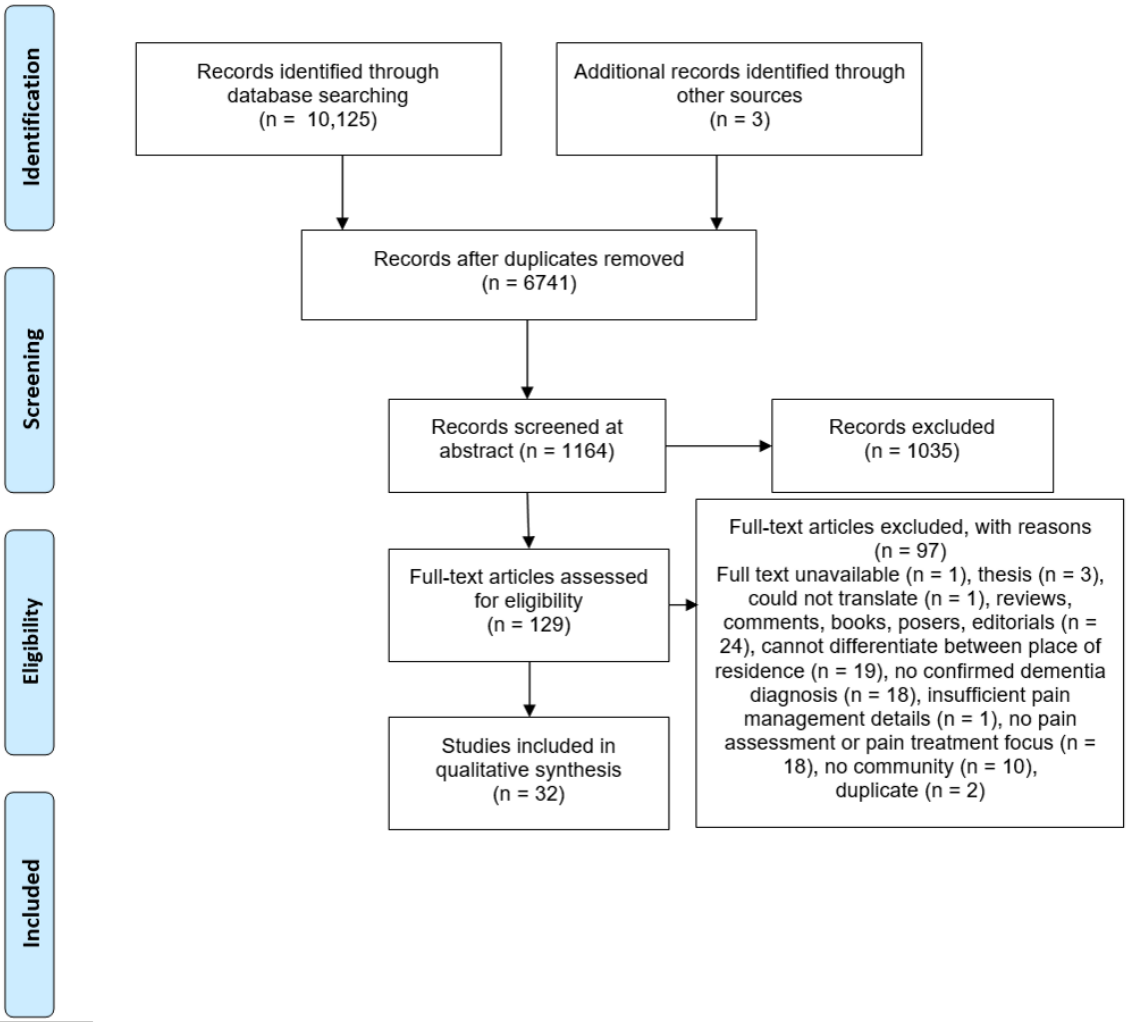

Figure 1 PRISMA flow chart

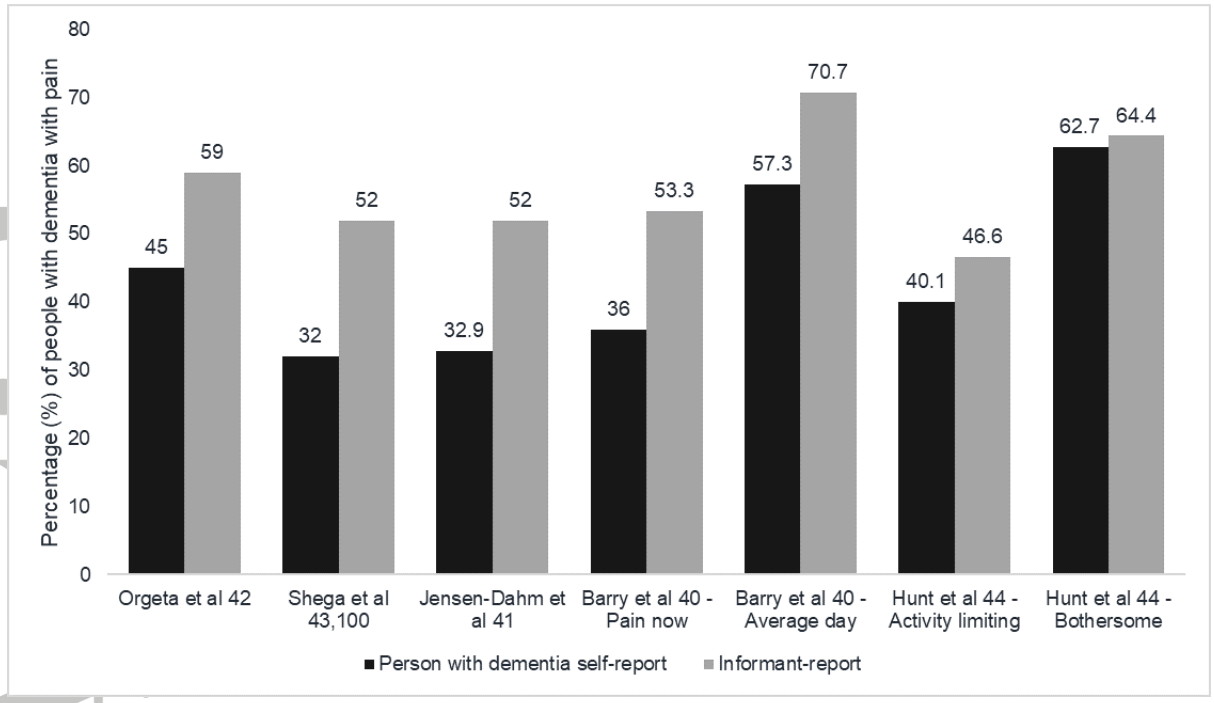

Figure 2 Percentage of pain self-reported by people with dementia compared to informant-reported pain by an informal caregiver

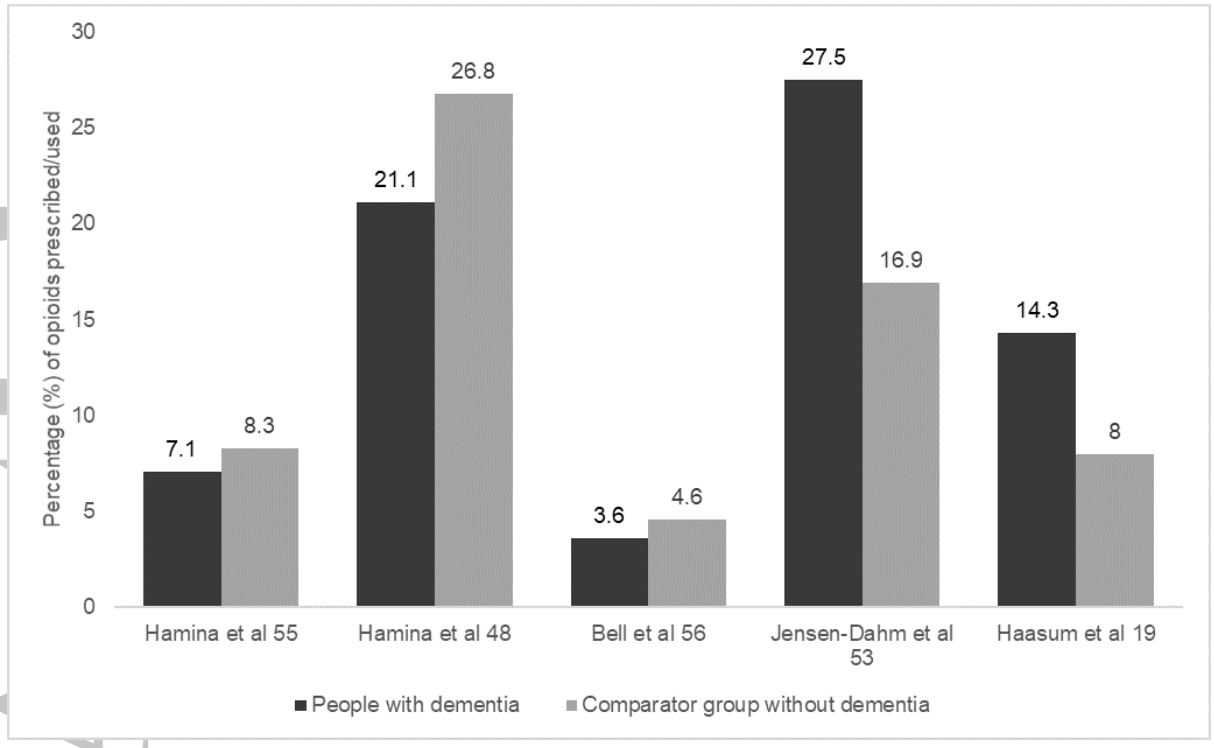

Figure 3 Percentage of opioid analgesics for people with dementia and comparator groups without dementia.